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TRANSPORT SERVICES AND THEIR IMPACT ON POVERTY AND GROWTH IN RURAL SUB-SAHARAN AFRICA: A REVIEW OF RECENT RESEARCH AND FUTURE RESEARCH NEEDS

ABSTRACT

This paper reviews recent transport services research in rural sub-Saharan Africa, with reference to the crucial significance of transport services for reducing poverty and encouraging growth. It focuses on issues key to improved well-being: generation of direct employment, broader economic effects on agricultural and off-farm activities, and social effects regarding health and education.. Throughout, the emphasis is on implications for vulnerable groups. Attention is drawn to the potential of recent developments, notably connectivities associated with motorcycle taxis and the rapid expansion of mobile phones. Significant knowledge gaps in the transport services arena are identified, from impacts of climate change, conflict and pedestrian portage to the economic valuation of transport, village transport operations and road safety. Suggestions are made regarding the type of studies and methods which could help to reduce some of these gaps.

KEY WORDS: transport services, vulnerability, employment, road safety, connectivity, motor-cycle taxis

1. INTRODUCTION

Although access to transport is vital for the economic and social development of Africa, efforts to address the continent's massive deficiencies in transport provision have been remarkably limited in scope and scale. The fact that transport is missing as a specific goal from the Millennium Development Goals, despite its crucial importance for their achievement, is particularly telling (Bryceson 2009; Grieco et al. 2009). In a recent review of African infrastructural development, Gwilliam et al. (2010: 219) refer to transport services as 'the forgotten problem'. In part, lack of attention to transport services can be attributed to the persistent, widespread assumption governing the development of Africa's rural roads that investment in roads will spontaneously lead to the provision of transport services. Roads have certainly been more commonly

foregrounded in literature on transport impacts than transport services. Given Africa's persistent development problems, the actual and potential role of transport services in enabling improved rural livelihoods and life chances for men, women and children living in poverty needs much greater attention.

This paper focuses on the period since the institution of the MDGs. The year 2000 is particularly significant for a transport review because it not only marked the inception of the Millennium Development Goals but also the publication of a substantial report by Booth, Hanmer and Lovell, 'Poverty and Transport', commissioned by the World Bank and DFID. Working from this base (after brief contextual discussions of historical background and the linkages between road investment and transport service development), evidence is examined regarding the impact of transport services on poverty and growth over the last decade. Key topics in a rural development setting must include not only transport services' direct role in economic life, as a generator of direct employment and broader effects on agricultural and off-farm activities, but also its pervasive social effects with specific reference to health, education and well-being. This draws attention to significant new developments which are changing conditions rapidly across much of Africa, including emerging connectivities associated with motorcycle taxis and the rapid expansion of mobile phones. Gender is a major cross-cutting theme, given its enormous influence on access to transport in African cultural contexts. In the second half of the paper, significant gaps in Africa's transport services knowledge base are identified and suggestions made concerning the studies needed to help fill them.

The review draws on published literature and personal field experience. Web searches for relevant peer-reviewed publications were made using Web of Science [Transport services/rural access AND poverty AND growth, further refined for Africa/distance/roads/education/livelihoods/environment/climate-change/transport costs/mobility], then similar searches conducted with Google Scholar. Reference is also made to work recently conducted under the DFID-funded Africa Community Access Programme [AFCAP], which provided the impetus for this study. The review has been

an essential precursor to identifying and commissioning new research for the programme.

2. BACKGROUND: TRANSPORT SERVICES, POVERTY AND GROWTH IN AFRICA IN HISTORICAL PERSPECTIVE

A brief outline of transport provision in the twentieth century aids understanding of trends and patterns post-2000. Transport services played a vital role in shaping the livelihood repertoires of rural people in sub-Saharan Africa in the last century, but precise implications for poverty alleviation and growth have varied considerably over time and place and between different sectors of the population (Porter 2012a). The expansion of motorised transport services followed rapidly after road construction in many parts of the continent from the early decades. Typically they focused on linking major export producing areas to coastal ports along characteristically dendritic routeways, which were constrained within the boundaries of the colonial administrative power concerned. Trucks commonly provided feeder services to the railways, a key transport mode for the evacuation of agricultural produce and minerals for export in colonial Africa. However, political economy analyses remain cautious regarding positive impacts of these developments for in-country poverty reduction and growth in that period. Large areas remained un-served by all-season roads and thus often inaccessible to motorized transport services. Consequently, the vast majority of produce for home consumption (and probably the vast majority of produce at the first stage in transport of goods destined for export) was head-loaded. In most cultural contexts, non-commercial portage was (and still is) seen principally as work for women and their children.

Since Independence, the pattern of transport services has changed in detail, but many of its broader features persist. One of the main changes has been the decline of rail transport services in many regions, as road construction and associated, more flexible, motorized road transport services expanded. However, at the inter-regional and international scale, the fractured transport system which had developed in the colonial era, reflecting metropolitan interests, has continued to hamper transport and associated

trade across the continent (Pederson 2001; Teravaninthorn and Raballand 2008). The vehicle stock has also changed, but since rural transport services commonly need to cater extensively for passengers accompanying their freight, there has been continued widespread dependence on vehicles with substantial mixed carrying capacity, whether (in earlier days) traditional mammy-wagons, or (more recently) imported second-hand minibuses. Bicycle ownership has offered a complementary transport mode for personal travel and smaller loads, but mostly for men – in many regions women and girls are (still) discouraged from cycling (Malmberg Calvo 1994,; Doran 1996:25; Flanary 2004; Porter, Blaufuss, Acheampong 2012). Women and their children, however, have continued to play a dominant role in unpaid domestic and intra-settlement head-porterage, often in support of family commercial activities (Porter 2011; Porter et al. 2012a).

The most recent - and arguably the most dramatic - development in rural transport services in many countries since the early 20th century introduction of motorised vehicles has been the expansion of motorcycle-taxi services, which gathered pace in the 1990s. These are still penetrating remoter rural areas today, fuelled particularly by the availability of cheap imported Chinese motorcycles. This development has special significance because it has occurred at roughly the same time as the expansion of mobile phone networks and the acquisition of handsets even in poor rural households. For the first time in African rural transport history many –even very poor - rural dwellers may have the potential to summon transport when they need it. For people living in remote areas the consequent new levels of connectivity amount to a transport revolution because, even if they cannot afford transport on a regular basis, many can now obtain it in emergency contexts and perceive this to be of crucial importance to their well-being. Implications of this change are noted at various points in the discussion below.

3. THE FORGOTTEN PROBLEM OF TRANSPORT SERVICES

There is a persistent, widespread assumption governing the development of Africa's rural roads that investment in roads will spontaneously lead to the provision of transport

services by the private sector as passenger and freight operators benefit from lowered vehicle operating costs and travel time savings and that this will bring cheaper and better transport for all, through competition (as Hettige 2006 noted in a review of Asian road impacts). Even if the poor do not benefit much directly, it is assumed they benefit indirectly through the trickle-down of economic growth (Njenga and Davis 2003).

However, the relationship between rural road investment and transport service development (and consequent impacts on the poor) is not straightforward. Bryceson et al. (2008), drawing on surveys in Ethiopia and Zambia, reinforce earlier conclusions (Dawson and Barwell 1993; Ellis and Hine 1998) that roads are not enough, especially where the rural poor are concerned. In Ethiopia, in an on-road well-connected village, income was found to correlate with travel speed whereas, in off-road areas with poor connectivity, all income groups faced similarly constrained transport choice. However, such on-road villages in Ethiopia attract better service infrastructure and staffing so that requirements to travel may actually also reduce for all inhabitants. Accessibility improvement may be of greater significance in such cases than mobility enhancement, a point made many times in the literature since Airey's 1985 analysis of the 'de-isolating' impacts of rural roads in Sierra Leone on health and school siting, i.e. in the early stages of road improvement, prior to the development of a dense road network.

Road provision does not necessarily lead to lower transport fares: in the absence of competition there is no incentive for road transport providers to improve services or pass on cost savings (mostly from reduced maintenance costs) to users: transport prices may thus fail to fall sufficiently to allow the poor and very poor to access transport services even where these are available (Hettige 2006). Competition among transporters may rise only when roads are improved to all-weather standard, especially on bitumen roads: on many earth and gravel roads across Africa competition is mostly absent. There is certainly some evidence in the post-2000 literature to suggest that all-weather roads often have a mostly positive impact on poverty alleviation and growth in rural Africa (Anyanwu and Erhijakpor 2009; Dercon et al. 2009); benefits may accrue through four channels – reduced costs of acquiring inputs, increased output prices, reduced impact of shocks and permitting entry into new, more profitable activities

(Dercon et al. 2009). Clearly, such road-related benefits implicitly require - and are likely to generate - some associated expansion of transport services, but detailed empirical evidence concerning the specific interrelations between road construction, road improvements and transport services and their impact on poverty alleviation and growth remains sparse. Economic decision models such as RED (Roads Economic Decision Model), a simpler version of HDM-4 (the Highway Development and Management Model, still do not adequately capture the impact of rural road improvements on travel time or wider social benefits (Teravaninthorn and Raballand 2008: 99, 101).

4. TRANSPORT SERVICES, EMPLOYMENT AND ECONOMIC LIFE

This section reviews direct employment in transport services, a commonly overlooked facet of transport impact, before considering the agricultural and other off-farm activities that typically characterise economic activity in rural Africa.

Direct employment: There are the many very poor rural people who obtain a direct income from providing transport services. Cart pushing, commercial head-porterage and linked activities like bicycle repair, tyre vulcanising, minibuss call boys etc., have long been an important employment niche for the very poorest young men and boys. Now, in countries where motorcycle-taxis are common, they also drive these for (often urban-based) employers, usually on some form of hire basis (e.g. Howe 2003). In some rural areas, this employment appears have helped to keep young men in the village where otherwise they would drift into town in search of work (Porter 2002b; Porter, Tewodros et al. 2013). Direct *paid* employment from transport service activities in rural areas is less commonly obtained by women and girls, though it occurs in some locations (as with girl porters in the Malawi charcoal trade).

Transport services and agriculture: Transport services are essential for the evacuation of farm produce to bulking centres and markets. This may include pedestrian load-carrying, which impacts substantially on women's time budgets, and consequent time-poverty, contributing to reduced time for both productive tasks such as farming, and

reproductive tasks including childcare and community participation. Intermediate Means of Transport (IMT) such as push carts, animal-drawn carts or bicycles still play a vital role in many regions (Starkey et al. 2001, 2007), despite widespread preference for motorized transport, because of their relatively low cost. However, IMTs are often seen as men's equipment: women's use may even be culturally prohibited, especially where draught animals are concerned, but more often women simply do not have the financial means to purchase IMT (Iga 2002; Mwankusye 2002; Flanary 2004; Porter and Lyon 2006; Starkey et al. 2007; Porter, Blaufuss, Acheampong 2012).

Although the majority of studies of market access focus on road connectivity to markets, rather than on the role of transport services, observations across Africa suggest that an all-season road is more likely to be associated with regular motorised transport services than a poor road and, if agricultural conditions are favourable, production and associated prosperity in the farming population will be higher than in remoter areas with poor access (Dorosh et al. 2012). In the case of perishable products, such as tomatoes, cassava or plantain, motorized transport often plays a crucial role in travel time for ensuring adequate market access while produce is still in good condition. Kaumbutho et al. (2013) emphasise the high cost of the first stage of produce evacuation (field to collection point) for fresh fruit and vegetables in Kenya, such that in one case (Mwea district) the shift from portering to oxcart could halve overall transport costs, while in Meru district changing from head-portering to motorcycle reduces overall costs by roughly one third.

In remoter areas, costly access to markets is a major hindrance to growth: farm-gate prices for agricultural produce (often the mainstay of livelihoods in remote areas) will be characteristically low compared to those prevailing in more accessible locations. There will also be limitations on the nature of produce which can be sold, since perishability limits market potential. If markets have to be accessed on foot, or delays are experienced because of sparse, unreliable transport services, sellers may arrive at market too late to obtain a good price or even to meet any potential purchasers; if their produce is perishable it may spoil in transit. Key inputs, notably fertilizer, are also likely to be restricted (Farrow et al. 2011). However, access to mobile phones is now

assisting increasing numbers of farmers (and traders) to make more efficient use of transport services (Overa 2006; Kaumbutho et al. 2013). The potential to benefit from such improved connectivities is growing rapidly across the continent as competition between network providers fuels the expansion and reach of low cost phone services.

Off-farm activities: Given the significance of multiplex livelihoods and off-farm employment to rural livelihoods and poverty alleviation (Bryceson 2002), transport services are likely to be of prime importance in enabling travel to alternative work and income sources (such as off-farm trading). Venter and Cross (2011) provide a rare examination of transport-related employment access issues in a South African context. In many areas across Africa women, in particular, rely on petty trading for a basic regular income, even though returns are low. They often walk long distances to access local markets but, when appropriate transport is available, may be able to travel to distant markets with better prices (and possibly less competition for their local products). For such women, the importance of reliable, regular, cheap and safe transport cannot be overemphasised. Moreover, reliable transport for the journey home so that they can fulfill their domestic duties is as crucial as reaching market on time (Porter 2011; Starkey et al. 2013).

5. TRANSPORT SERVICES FOR HEALTH, EDUCATION AND WELL-BEING: CRUCIAL REQUISITES FOR GROWTH

Good access to health and education services helps secure the educated and healthy workforce and wider community well-being that is essential for poverty alleviation and economic growth: transport services play a crucial role in this respect. Poor physical access to health services (especially maternal and child health) and to education impacts massively on human capital stocks. Remote areas, with few all-season roads, are doubly disadvantaged given their characteristically low service density and widespread chronic poverty (Bird et al. 2007). Linard et al. (2012) map population distributions across Africa and calculate average per-person travel time to settlements of more than 50,000 inhabitants as around 3.5 hours, with Central and East Africa

displaying the longest average travel times. The analysis highlights large inequities in access, the isolation of many rural populations and the challenges of providing access to services. Even if transport is available, fares are often too costly for the majority of people (Porter 2002; Christaensen et al. 2003; Bryceson et al. 2008).

As Geurs et al. (2009) observe in a Western context, social impacts of transport can be widely defined and are caused by a multiplicity factors, which may also reinforce each other. This section focuses principally on access to health and education because, in the extreme poverty experienced by many Africans, these services are of particularly vital significance [as the MDGs recognise]. Along with social networks, also discussed, they have been key elements of social impact examined in recent transport services research in Africa. The growing focus on transport issues among health sector researchers (some cited below) is a particularly welcome development. Geurs et al. consider transport/traffic-induced reductions in environmental quality: these are also important in some African rural contexts but, given low levels of motorised transport in many rural areas, rarely figure, as yet, in the literature: negative social impact is currently more concerned with *absence* than presence of motorised transport.

Health care: Recently, evidence regarding the specific role that transport services play in shaping access to health facilities has been growing. Even for basic primary care, travel time has been found to significantly affect levels of clinic attendance. For instance, Tanser et al. (2006), found 65% of rural homesteads in KwaZulu-Natal, South Africa travelled one hour or more to attend the nearest clinic, but there was a significant logistic decline in usage with increasing travel time. Low-cost, timely transport also improves pre-natal care (McCray 2004) and access to ARV therapy (Zachariah et al. 2006; Chileshe and Bond 2010; Feldacker et al. 2011).

The role of transport in maternal health and emergency obstetric care (even for women of high socio-economic status) is particularly evident (Cham et al., 2005; Muleta 2006; Babinard and Roberts 2006; Gabrysch et al. 2011; Orcutt 2013; Masters et al. 2013). In a study in Katsina state, northern Nigeria (where National Road Transport Workers

Union volunteering is now playing a remarkably beneficial role in getting women to health posts: Green et al. 2013), referral still presents considerable delays, despite state investment in ambulances. Although the majority of women take 1-2 hours between being referred and arriving at the referral facility, a significant number of women take between 4 and 7 hours; some have to make the journey on foot (Transaid 2013). Knock-on impacts of poor access to maternal health services not only include some of the highest rates of maternal mortality in the world, but also long-term damage, notably obstetric fistula, which affects all aspects of women's lives by keeping them virtually isolated from their communities.

For child health, transport service impacts on low vaccination rates (Bosu 1997) and access to emergency care are of particular concern. Ombok et al. (2010) find higher infant mortality in western Kenya associated with living further from roads with public transport. Bossyns et al. (2006) show for Niger how distance and lack of emergency transport are likely critical factors in low and delayed hospital referrals of children in remote rural areas. Such children are probably also more vulnerable to severe parasitic infections due to failure to access early treatment (Raso et al. 2005, re Cote d'Ivoire). Problems of physical access to reproductive health services may contribute to the high levels of teenage pregnancy observed in many rural areas and dangerous home abortions.

Road accidents and transport-induced pollution are health-related issues of growing concern in rural Africa, though the majority of literature as yet refers only to urban contexts (Lamont 2011). Olukoga and Harris (2006) calculated the number of road-traffic *fatalities* in rural areas of South Africa as 2.7 times that in urban areas. A Nigeria study (Labinjo et al. 2009), in seven Nigerian states, however, reports road traffic injury rates for rural and urban respondents as not significantly different. It may be that poorer access to treatment in rural contexts following injury is a substantial factor in high rural fatalities. Significantly, motorcycle crashes accounted for 54% of all road traffic injuries. Certainly, road safety problems of poorly maintained public transport, driven by poorly trained drivers over poorly maintained roads, are widespread (see Potgieter et al. 2006 re Eastern Cape, South Africa). Improved and new roads often bring increased traffic

speeds, higher traffic volumes and higher accident rates (Amend 2013). This may, in particular, increase women's caring burden (Kwamusi 2002). Meanwhile, the establishment of truck stops along major transit routes can encourage transmission of communicable diseases, including HIV/AIDs and other STDs (Mashiri 2004; Ferguson and Morris 2006).

Education: The majority of children in rural Africa walk to primary school (sometimes over long distances), which may contribute to late enrollment, truancy and early drop-out, especially when coupled with household labour demands. At secondary school level, where distances to school tend to be even greater, the constraints imposed by deficient transport services are often such that adolescent girls and young women, in particular, are simply unable to attend, unless affordable local boarding facilities are available, because of parental fears that they may be attacked on journeys between school and home (Porter 2011; Porter et al. 2010). Where transport has been improved, school attendance of girls, in particular, whether at basic or secondary level, has often benefitted (DFID 2001). However, the crucial importance of transport is little recognized in education sector literature.

Older people: The impact of deficient transport services on older people might seem to be of greater significance in terms of poverty than growth, but it is important to bear in mind that many older people play a vital role as carers of young people across Africa, in the absence or death of parents, especially in rural areas. Many must also continue to find a livelihood for themselves and those in their care. Poor transport services affect older people's ability to support themselves and the children in their care, since they may be unable to walk to distant markets and thus must accept very low farm-gate prices, while poor access to health services for themselves and their charges will inevitably also impact on children's access to education and future livelihood potential. Disability can affect all ages, but tends to be particularly prevalent among older people: for this group as a whole, transport services are of vital significance and deficiencies in transport services contribute to the chronic poverty in which many currently live, as Porter, Tewodros et al. (2013) demonstrate for Kibaha district, Tanzania. As yet, little

other research has been conducted on older people's transport problems in Africa (though see Ipingbemi 2010 for an urban study).

Social networks: The development and maintenance of social networks, so often key to accessing funds (e.g. for school fees), employment opportunities and broader well-being, are facilitated among all age groups where good transport networks exist (Davis 2005). The massive expansion of mobile phone use across Africa also supports many family and wider social networks (in addition to the commercial activities noted above). In the early stages of adoption, ownership among young people is higher among males than females but may even out or reverse subsequently (Porter 2012a). While phones now enable improved distance management, occasional face-to-face meetings facilitated by travel still appear to be key to maintaining strong social bonds (Samuel et al. 2005; Aker and Mbiti 2010; Urry 2012).

It is important to note how regular, reliable transport services not only enable access to services for the rural residents who need them, but also encourage and enable key service personnel (notably teachers, health workers, extension agents and NGO staff [Brass 2012]) who are so often determinedly urban-based, to at least travel to work in rural areas on a daily basis, thus providing regular services in rurally-located service sites.

6. THE POTENTIAL FOR IMPROVED TRANSPORT SERVICES: FROM INTERMEDIATE MEANS OF TRANSPORT [IMT] TO MOTORCYCLE TAXIS

Clearly, efficient, regular, reliable and affordable transport services play an essential role in promoting growth and reducing poverty. In many parts of Africa, however, transport services remain entirely inadequate for user needs. There is little incentive for existing transport providers to improve their service or pass on savings on vehicle operating costs to customers where competition is limited. Competition requires demand, which is usually closely linked to population density and wealth (agricultural/mining potential of the area; possibly also government encouragement of local marketing etc.), confidence about regular road maintenance, the removal of formal

barriers (such as restrictive government regulation like unnecessary army/agricultural ministry road checks) and informal barriers (cartels and rent seeking): most of these pre-conditions are widely lacking. In some remote places, demand is so low that it may be necessary to consider the role of credit and subsidy. However, there is limited experience of formal transport subsidy in Africa, except in South Africa where the cost and complexity of managing transport subsidy interventions, especially in the informal sector, remain significant issues (Walters 2013). Recent action research in rural Malawi highlights the likely significance of subsidy in many contexts (Raballand et al. 2011).

Improved transport services could impact very substantially on poverty and growth in rural areas, particularly once the potential for extended connectivity based on integration with mobile phone networks is considered. For the most part, different interventions are likely to be appropriate for intra-village and inter-settlement transport. *Intra-village transport* is in large part concerned with replenishing homes with water, fuel and locally-produced food. Reduced dependence on pedestrian load-carrying could be achieved through IMT interventions (in conjunction with any necessary path/track improvements) and non-transport interventions (such as additional water points, firewood reserves etc.). However, this will require a stronger commitment to IMT than has hitherto been achieved (Porter 2011). Many IMT schemes have been small, piecemeal interventions, in some cases promoted by hobbyists with inadequate appreciation of social and other contextual factors (Starkey et al. 2001; Porter 2002b; ITTransport 2003). Some larger-scale projects have also failed because of inadequate pilot ground work, such that inappropriate equipment has been promoted, communities inadequately prepared etc. In the context of a low-carbon future, attention to promoting contextually-suitable IMTs may once again become a prominent feature of donor rural transport agendas, though local elite perceptions of IMT as a synonym for primitive transport also need to be overcome.

A key factor for IMT intervention success is affordability - appropriate national fiscal policies and local microfinance schemes for potential adopters are both likely to be essential. Cost of IMTs remains a major issue among the very poor (who may often value the equipment most, including many women). Credit provision *per se* may not

present an adequate incentive for women to buy IMTs, unless the IMTs are appropriate and affordable (Starkey et al. 2001). IMT introductions require careful pre-intervention study and monitoring to ensure that the equipment is appropriate to the context, plus preparatory work with communities to ensure adequate recognition is given to the need to budget for repairs, maintenance training etc. Reduced novelty of IMT equipment would allow more use by women, but IMT can even aid women in contexts where they are unable to gain control of the equipment, if the presence of such equipment encourages men and boys to take over female tasks (Porter, Blaufuss, Acheampong 2007, 2012). Very basic IMTs, including wheelbarrows, could be of considerable value in many locations. For emergency health travel from remote settlements with poor roads, IMT equipment - notably motorcycle ambulances - could play a much larger role (Hofman et al. 2008), especially when linked in to mobile phones, as recent trials in eastern Zambia demonstrate (Dennis 2013). Attention to building a critical mass of key equipment and research into novel ways of promoting equipment sharing, beginning in the most favourable locations, could reduce costs and increase acceptability (Starkey et al. 2001). Meanwhile, the importance of non-transport interventions - boreholes, fuelwood plantations, portable grinding mills, girls boarding facilities at schools, maternity waiting homes etc. – is noted regularly by transport researchers. However, in the absence of strong connections to other sectors - agriculture, natural resources, energy, health, education – which might promote attention, they still fail to attract adequate attention.

For Inter-settlement travel over longer distances, the motorcycle-taxi is now changing the face of rural transport services in many parts of Africa. It is increasingly common for very poor people to have access to mobile phones and to keep the numbers of taxi-drivers and other transport operators to hand (author field observations). The efficiency advantages gained when motorcycle taxis can be contacted by mobile phone are particularly impressive, such that even very old poor people may patronize motorcycle-taxi services in areas where these services have only been recently introduced (Porter, Tewodros et al. 2012). Although fares tend to be higher than for other transport, motorcycle-taxis are not only reaching remote villages where there is no alternative service, but services are being stationed within those villages (rather than being limited

to base-stations at the paved road, as has commonly been the case with conventional motor taxis) (Porter, Tewodros et al. 2013; Starkey et al. 2013). A growing pattern in rural areas is for motorcycle taxis to act as feeder services, linking off-road villages to other (cheaper) motor transport at the paved road. Conventional taxis usually do not find it profitable to operate from or into remote locations due to insufficient demand and the fact that 4-wheel vehicles cannot easily negotiate unsurfaced tracks, especially in wet conditions.

Despite the evident value of motorcycle-taxi services, improvements are urgently needed, given the prevalence of accidents associated with their operation. High accident rates seem to be ubiquitous in locations where motorcycle-taxi services are well established, impacting not only on the young men who mostly operate them but also on their (usually female) carers and on already stretched medical services.. For this reason, a number of states, including Ghana and South Africa, have banned their operation. Recent studies in Tanzania (Amend 2013) have identified key safety issues which will be of growing significance as motorcycle usage expands across Africa:

- Insufficient attention is paid in road engineering to the question of road access conditions where motorcycles are now the dominant transport. Motorcycles need a firm, cambered running surface but at a much reduced width than that required by conventional 4-wheel vehicles. Experience in Vietnam may have some relevance (though lower population densities than in Asia could be an inhibiting factor): here, communities have constructed their own (1.4 metre) motorcycle roads of concrete which can allow two motorcycles to pass at normal speed, and 0.5 metre concrete or fired clay brick tracks in remote areas where cycles are unlikely to have to pass each other regularly (Petts, Rural-transport-development network 18/9/2009). However, it is important to bear in mind that better road surfaces often encourage drivers to increase their speeds, and thus it is necessary to also consider appropriate traffic calming measures in areas around schools, settlements etc.
- Motorcycle driver training needs urgent attention. Drivers are supposed to be licensed, but corruption in the licensing authorities and police is so often

prevalent that a majority of drivers probably operate without adequate training. Moreover, many are extremely young men (driving at age 14 years is not uncommon) who enjoy the speed and thrills of this work and take undue risks. Driver training specifically geared to motorcycle-taxi drivers is urgently required. This needs to cover issues such as passenger numbers and helmet wearing, driving techniques, road safety, carrying procedure for older/sick/disabled passengers etc.

- Helmet usage is often required by law, for drivers and their passengers, but rarely implemented or adequately enforced. The importance of helmet-wearing can be stressed to drivers in training, but it also needs further consideration, since many helmets are of substandard quality, offering little protection to the wearer, and operators need to have a second helmet available to passengers.

It is likely that the new connectivities associated with the expansion of mobile phones and motorcycle taxis will dominate intra-settlement travel developments in many remoter rural locations away from the paved road in Africa for some years to come. They may well also have wider knock-on impacts on the nature and organisation of rural transport services, though it is difficult as yet to predict likely areas of change, which will depend in part on local context and the wider political economy. Nonetheless, improvements in service quality associated with developments of this type can be expected to lead particularly to improvements in journey time, reliability and (hopefully) safety; reductions in fares are likely to take longer to achieve, and will depend partly on the degree to which competition develops between service providers.

7. REVIEW AND PROSPECT: SOME KEY RESEARCH GAPS

Although broad areas where improved transport services could aid poverty alleviation and growth are identified above, some specific research gaps in the transport services arena are evident. They can be loosely grouped as follows: (i) at a global scale, climate change impacts and the influence of the newly emerging economies on transport services in Africa; (ii) within the continent, internal political economy issues, notably conflict and the socio-political context of transport decision-making; (iii) socio-

economic issues, focused around specific user needs and wide rural livelihood concerns; (iv) village-level transport operations, including road safety and the potential for improved transport coordination through mobile phones. Satisfactory exploration of each of these issues requires a stronger understanding of relevant policy and practitioner environments.

7.1 The impact of global influences

Starting from a global perspective, understanding of likely **climate change** impacts on transport services is a major knowledge gap. We need to know how linkages between transport, environment and climate change are likely to impact on rural populations in terms of risk, vulnerability and resilience; also, what specific interventions will be needed for pro-poor climate change mitigation, adaptation to progressive climate change, and managing climate risk in rural transport contexts. It will be vital to engage decision makers at all levels in a fully participatory process to confront the need for action on both mitigation and adaptation (as Banister and Hickman 2013 emphasise for Asia).

A different kind of external influence is evident with reference to the impact of the **emerging powers** on Africa. Future transport services are certainly likely to be shaped, in part, by goods and ideas imported into Africa from China and India (phones, motorcycles, possibly low-carbon vehicles etc.). While positive influences have been noted above, the potential for new impacts – positive and negative - to develop as linkages to external powers deepen may need investigation.

7. 2 The African political-economy context of transport services

Africa's changing political economy presents other challenges. The need for work on the role of transport services in fragile and conflict-affected societies and states was noted in the World Bank Group's transport business strategy for 2008-2012 (2008). This recognizes the potential role of improved transport in helping to rebuild economies in post-conflict countries and lessen vulnerability to future conflict, such as overcoming potential disputes over access to resources, and defusing the seeds of conflict sometimes arising out of feelings of isolation. However, there is a lack of in-depth

research regarding means whereby this can be achieved. There has been a small amount of work on transport as a *source* of conflict (notably South Africa's taxi wars) but this is urban-based. One potential area for research may be into the role of social networking tools for addressing transport conflicts.

There has been a tendency in much transport services research, even in stable political contexts, to focus more on technical issues and downplay social and institutional factors which significantly shape transport management, use and impacts. This may be attributed partially to the difficulties of pursuing investigations which are potentially highly sensitive (and have, in the past, occasionally put individual researchers in physical danger). Nonetheless, a stronger focus on political economy is needed to explore the nature of transport decision-making at national, regional, district and community levels. The significance of political influence on road programmes is well recognized, but there are many other aspects associated with the socio-political context of transport decision-making which merit investigation, such as the importance of transport in building social networks, government/union relations etc. The role of transport services in improving poor people's access to the political process (i.e. physical access to local government offices, especially important in the context of state decentralization; Porter 2002) is a related gap.

7.3 Socio-economic issues: user and wider livelihood perspectives

A major research gap concerns methodological issues in applying transport economics in African contexts. There are major unresolved issues for instance in assessing rates of return from transport developments in health, education and agriculture and the complementarities associated with social benefits: standard techniques used in Western contexts are not easily applicable.

Also, although the quantity of empirical data on socio-economic aspects of transport service provision in Africa has expanded, important research gaps remain, especially regarding youth and older people. High youth unemployment rates are of widespread concern: they have important implications for economic growth and for inter-generational poverty transfer. Transport services are implicated in young people's

access to education and training, access to work places (including off-farm work) and as a direct employment option. Means of improving girls' access to and use of bicycles towards improved school attendance or employment, for instance, are little understood (Mahapa 2003), while the role of transport as a niche employer for the poor (notably young men's employment in motorcycle-taxi businesses) raises questions regarding its potential to enable movement out of poverty and into other entrepreneurial roles. The elderly, meanwhile, may be discounted in growth-focused work, but certainly play a key caring role for children and youth in many rural areas. A deep understanding of transport-related social exclusion is essential for addressing wider issues of poverty and growth, particularly in areas such as inter-generational poverty transfer, an issue which is now attracting attention in Western contexts (Schwanen and Paez 2010).

By contrast with other vulnerable groups, there has been substantial research on women's transport exclusion in Africa, as this review indicates, but this knowledge has rarely translated adequately into policy and practice: there are token efforts at gender mainstreaming in transport projects, often as a response to donor requirements, but this still mostly amounts to little more than 'ticking the gender box' (Turner 2004; Porter 2008). The failure of transport planning to improve women's access to facilities and services is a major concern. To ensure uptake of findings about vulnerable groups, it will be necessary to undertake in-depth (qualitative) studies of the transport policy and practitioner environment in order to identify where and why information does not translate adequately into action and find means to rectify this.

On a related issue, the impacts of load-carrying on health remain essentially unknown: the majority of current information is little more than anecdotal (Porter et al. 2013). Medical research on load carrying is needed, but the issue falls awkwardly in the gap between medical, transport and social science expertise. Moreover, potential interventions to reduce load-carrying raise difficulties: if it is highly damaging to affected populations, we would need to find practical low-cost interventions to enable a reduction in carrying. This could present a new impetus to innovation in and interventions with Intermediate Means of Transport. Or it may be more a matter of establishing parameters for ergonomic guidelines regarding avoidance or reduction of head-loading

practices detrimental to health together with appropriate health interventions and associated policy recommendations.

Broader livelihood-focused studies still rarely contain adequate consideration of rural transport issues and their implications for rural incomes and time budgets (Bryceson et al. 2003). The role of transport services in improving access to financial services (banks, cheaper credit sources, MPESA operators), are of considerable importance, given the crucial role of credit availability for entrepreneurship and economic growth. Transport services may also have a major impact on patterns and processes of urbanization with important implications for livelihoods, rural and urban. These impacts have not been adequately charted, though Venter and Cross's study (2011) of transport-related employment access issues in South Africa suggests fruitful directions for future work.

Where transport has been linked to rural livelihoods, the focus tends to be on users working in small-scale farm and off-farm petty trading contexts. Transport service issues are rarely considered in large commercial agriculture or mining contexts, despite the fact that large firms in agriculture and other industries are more likely to complain about transport than smaller firms, with substantial losses reported from theft and transport delays for their company-owned transport (Ramachandran 2008). There is need for much more empirical research in this arena: in addition to their role in national economic growth, in many cases these large commercial enterprises play an important labour role as employers of the very poor. The lack of comparable, cross-country and time series data on transport and logistics costs in Africa (Naude 2009) is clearly a significant research gap (i.e. country-level assessments of the local trucking industry, including the impact of state taxation policies on fuel pricing, levels of vehicle imports, implications for transport costs and prices etc.)

7.4 Village-level transport operations

Remarkably little is known about the operation of rural and village level transport services: the role of transport operator associations in route designation; fare setting; timetabling; training; road safety and driver/passenger interactions with police and other

relevant actors etc. In-depth socio-economic-focused qualitative research is needed in diverse contexts if services better geared to user needs are to be developed. This would complement studies of user and policy perspectives. In particular, research into motorcycle-taxi operations is essential, ranging from economic returns in the sector, to improved road access for motorcycles, safety and organizational features (as discussed above). There has been inadequate research on successes and failures in transport service development: motorcycle-taxis provide, in many locations, evident examples of private-sector-led success. Research into a) patterns of penetration of motorcycle-taxis across sub-Saharan Africa, and their (gendered) impacts on poverty alleviation and growth, linking this to institutional, economic and socio-cultural factors; b) cost-effective road/track design to support their safe use; c) other road safety aspects; d) organizational factors such as unionization, would all substantially aid development of appropriate policy to support the sector.

More broadly, we need **longitudinal economic and social assessments** of the impact of roads on transport services, including in locations beyond a narrow road corridor. Transport-related impact studies tend to focus on road impact per se, and assessments are commonly focused spatially on very narrow corridors along study roads. Moreover, impact assessments are usually made soon after road construction/improvement is completed, and rarely repeated some years later, to see what has happened in terms of transport services and local livelihoods (e.g. through changes in crop production levels, marketed output etc.) in the interim. Impact studies should be broader, to encompass a) road impacts on transport services development, b) impacts across a wider spatial area (i.e. into off-road areas beyond the five km zone), c) temporal studies which consider impact over a substantial time-frame i.e. pre-intervention; immediately post intervention (after c. two years); subsequently periods (e.g. five, 10, 15 years post-intervention), d) qualitative and quantitative assessments of potential livelihoods impacts which cover a wide range of factors through a gender and age lens.

As noted above, virtual mobility through use of **mobile phones** has substantial potential to synchronise and beneficially reduce the transport needs of all sectors of the rural population. ICTs – principally mobile phones – are now fundamentally changing the

organization of travel in many African households. Given the need for more sustainable transportation, potential interactions between the virtual mobility facilitated by mobile phones and the physical travel afforded by transport services are of great importance. Research which is specifically focused on current and potential connectivity between travel and mobile phone use (including data sets disaggregated by gender-, age- , occupation etc.) would make an important contribution to transport services planning. Assessments of current and potential phone impact on travel patterns (i.e. virtual versus physical mobility) are particularly important in the context of climate change.

The need for an expansion of research into **road safety** issues and interventions is widely recognised in Africa and will gain some impetus from the UN Decade for Action for Road Safety (2011-2020). As yet, however, there seems to have been little specific attention to consideration of key issues such as road safety training for motorcycle taxi operators, out-of-school children etc. or the collection of gender- , age- and locationally-disaggregated data on road accidents. The 2007 Pan-African road safety conference identified issues such as the need to mainstream safety design issues in road investment programmes; collect reliable road accident statistics and enact national legislation to deal with speeding, driving unroadworthy vehicles, failing to use safety helmets, using mobile phones while driving, and driving under the influence of alcohol. However, implementation of road safety legislation is a major hurdle across Africa: this requires better understanding of the factors shaping current non-compliance and associated investigation of means to eliminate corruption in licensing, enforcing on-road behaviour and inspecting and controlling vehicle condition. So far as children's road safety is concerned, it is important to note that school-focused road safety work does not take account of the very many children who never attend school and may be at most risk of road accidents through working as road-side traders. Action research focused on making interventions and monitoring their effectiveness in this and other areas is probably a key route to improvement (Amend 2013).

8. CONCLUSION

The material presented in this review provides a strong indication of the critical role that regular, reliable and affordable rural transport services can play in promoting positive development in sub-Saharan Africa, and – where absent- in retarding it. Interestingly, in terms of research into social exclusion, work in African contexts has arguably kept pace with and offers valuable pointers and perspectives to researchers working in other world regions, both Western and developing. This is particularly the case regarding use of innovative participatory approaches such as mobile interviews and co-investigation with communities (see Lucas and Jones 2012). However, it is vital that the knowledge collected translates into improved policy and practice: it is extremely disappointing that the detailed knowledge that has been gathered over more than two decades concerning rural women's transport problems in Africa has not, as yet, induced adequate remedial action.

Clearly, much research still remains to be done in the rural transport services field in Africa to support poverty alleviation measures and promote economic growth. A stronger evidence base is essential. Additionally, strong uptake pathways are needed to ensure that research is transformed into action. As attention turns towards development post-MDGs, the importance of obtaining a higher profile for transport, particularly transport services, in development discourse needs urgent attention. Stronger advocacy is needed to promote the concept of transport services' centrality to development.

This in turn requires greater attention to building cross-sectoral linkages and associated alliances: in health, education, environment and energy, as well as agriculture (where the World Bank SSATP is now forging significant linkages; see Banjo et al. 2012). To achieve this, a much stronger emphasis on support to capacity-building in ministries and universities will be essential. Demand-led work in Africa is greatly hampered in the transport services field because of current capacity shortages, especially in central (but also local) government; this greatly hinders uptake of findings that have emerged to date from transport services research. University-trained transport services specialists with expertise in African transport issues are rare: there is a lack of post-graduate courses in transport services focused on low income countries. South-South learning could help support research in transport services in Africa (though it is important to bear

in mind that much Asian experience in this field will not relate directly to many African contexts, not least because of the very different demographics). Presence of transport services specialists based in African ministries (roads/transport and cross-sectorally) would substantially improve the transport sector profile and the potential for impact.

Greater attention is also needed to supporting multi- and, in particular, inter-disciplinary research which brings social scientists together with transport engineering specialists in strong partnerships and promotes a holistic approach i.e. research which will contribute to integrated mobility and accessibility planning. While there are some excellent examples of strong working relationships between engineers and social scientists in project *implementation*, this is rare in research contexts, especially in terms of *interdisciplinary* as opposed to multi-disciplinary research. There is also need for a much stronger social science input. Rapid survey research is a valuable tool, but is unlikely to provide the depth of understanding essential, for instance, either for sound economic benefit analyses, or for a political economy approach. If transport research is to move substantially beyond descriptive reviews, in-depth qualitative research will be a key component in the development of strong mixed-methods methodologies. Although participatory studies of transport disadvantage and the social exclusion of low income groups have been gathering pace, much remains to be done.

Finally, regarding methodology, a stronger focus on action research approaches, where transport interventions are followed by very close community-based monitoring over a period of at least one year, preferably more, would be beneficial. This is time-consuming but could greatly improve understanding of what works, or doesn't work, for whom, in what circumstances, and why. This would aid IMT and other interventions such as trials of transport subsidies (as so effectively demonstrated by Raballand et al. 2011). Linked to this, more use of participatory techniques in gender- and age-disaggregated data collection and associated engagement of communities in transport planning would help to further elicit and evaluate differential mobility (Vajjhala and Walker 2010).

This is an exciting time in the evolution of Africa's rural transport scene. As the review suggests, although research progress has been made since 2000, new studies are urgently required to explore recent developments. The challenge will be to ensure that the research focused on poor rural populations supports their potential to benefit fully from the new connectivities emerging. Progress to date in getting user needs adequately addressed (notably women's transport exclusion), has been disappointing. Promoting stronger commitment to uptake of research findings in policy maker and practitioner communities will require concerted efforts from a wide spectrum of actors, both within and outside the continent.

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